Shurly (E. L.)

A Report on the Origin and Geographical Distribution of Phthisis Pulmonalis for the State of Michigan.

BY

E. L. SHURLY, M. D.,

~~DETROIT.~~

REPRINTED FROM

The New York Medical Journal

for November 14, 1885.

Reprinted from the New York Medical Journal for November 14, 1885.

A REPORT ON

THE ORIGIN AND GEOGRAPHICAL DISTRIBUTION OF PHTHISIS PULMONALIS

FOR THE STATE OF MICHIGAN.*

By E. L. SHURLY, M. D.,
DETROIT.

Mr. President and Gentlemen: The object of the investigation upon which this imperfect report is based is to ascertain, if possible, what, if any, influence is exerted by strictly telluric environment upon the causation of phthisis pulmonalis. The aërial and social factors of its ætiology have been for a long time freely and widely discussed, but the telluric aspect and geographical distribution, according to my observation, have received much less consideration, and perhaps deservedly, although it seems to me that we have too little knowledge on this point to warrant such a decision.

Circulars were sent out to the profession of the State of Michigan asking for data relating to the number of cases of phthisis pulmonalis which had *originated* only in the township or county where the practitioner resided, together with a statement of the number of such patients who were

* Read before the American Climatological Association, May 28, 1885.

known to have hereditary predisposition, and whether primary or secondary. Although a large number of replies were received, I regret to say the number was somewhat less than I had hoped for.

As the number of physicians who keep notes of cases is small in the aggregate, I endeavored to shape the queries as concisely as possible, and to ask for so little that almost any practitioner could fill out the answer from memory and with the consumption of very little time. To those who were good enough to reply I feel greatly indebted, and I believe all who are interested in this subject will also share in this feeling.

I thought it advisable, even at the risk of wearying you, to precede the tables with a few extracts from the reports of Professor Winchell and Dr. Rominger, showing the topography of the State.

I am greatly indebted to Dr. A. W. Nicholson, lately of our State Board of Health, for the general and census tables, and to Dr. Erwin Wright for the preparation of the other data in the form presented.

Topography, Hydrography, and Geology.

"The two natural divisions of the State are distinguished by marked physical characteristics. They are completely cut off from one another by the Straits of Mackinac. The northern is rugged, with numerous rocky exposures; the southern consists of plains, plateaus, gentle undulations, and moderate hills, with very few outcrops of rocky strata. The northern peninsula is a mineral region; the southern, agricultural. The climates of the two peninsulas are as distinct as their location and topography."

"The climate of Michigan, both in summer and winter, is well adapted to the interests of agriculture and horticul-

ture. Its marked peculiarity is attributable to the influence of the great lakes by which the State is nearly surrounded. It has long been known that considerable bodies of water exert a local influence in modifying climate, and especially in averting frosts; but it has never before been suspected that Lake Michigan, for instance, impressed on the climatic character of a broad region an influence comparable with that exerted by the great oceans."

"The influence of the sea in equalizing temperatures has long been understood. The immunity from unseasonable frosts secured by bodies of fresh water to localities in their immediate neighborhood has also been universally observed; but the fact that inland lakes of the size of Lake Michigan exert an ameliorating agency quite comparable with that of the Atlantic Ocean is something which has only been brought to light by recent thorough discussion of a wide range of meteorological data."

Distribution of Precipitation through the Seasons in Percentages of Total Precipitation.

	Spring.	Summer.	Autumn.	Winter.
Upper Peninsula.....	19·0	27·0	28·8	22
Lower Peninsula.....	25·8	28·7	27·3	19
Whole State.....	23·8	28·3	27·7	20

It appears that the northern localities experience a somewhat greater liability to dryness in all seasons. It must be borne in mind, however, that the percentages given are percentages of the seasonable means.

"A general glance at the superficial configuration of the lower peninsula reveals a surface swelling gently from the shore toward the interior regions."

"Generally the lake shores are depressed."

"The rise of the peninsula from the level of the lakes is

generally gradual, and in a few places only is it abrupt. The surface is of an undulating, hilly character; the hills are rounded, and never attain a very great height above the surrounding country. The southern peninsula is lower than the northern. The swell of the land forming the water-shed of this southern division coincides with a line drawn in a southwest direction from Port Austin, at the entrance of Saginaw Bay, to the southwest corner of Hillsdale County, where it enters the boundaries of the State of Ohio. Within the limits of Tuscola and Sanilac Counties the known surface elevation of this water-shed is about four hundred feet, while in Hillsdale, not far from the southern State line, some points with an elevation of six hundred feet are recorded; but the water-shed is probably not over five hundred feet high."

"This, which may be called the southeastern water-shed, is not broken through by any of the streams, though deeply excavated by the Huron River in Washtenaw County."

"The descent from the height of the water-shed to the lake shore is so gradual that a traveler in crossing the peninsula from either lake to the other, if he follows the river valleys, can scarcely perceive it. The northern division of the peninsula rises to nearly double the height of the southern part; its surface is more broken and diversified by steeper ascents from lake to terrace. Its highest points in the vicinity of Otsego Lake are, according to the records of the railroad surveys, eleven hundred feet from the lake level. Otsego Lake lies directly west of Thunder Bay, and not far from the northern terminus of an extensive high plateau with undulating surface, and an average elevation of from seven hundred to eight hundred feet."

"All the rivers of the northern part of the peninsula have their source within this plateau, which is dotted with a number of inland lakes, some of which, like Lakes Hig-

gins, Houghton, and St. Helen's, are of large size. The terraces by which the descent from the plateau is made form a succession of broad belts; their sides are moderately steep and finely timbered; the lowest are wider, gradually slanting toward the shore, or overlooking it in bluffs of from forty to sixty feet."

In some places on the west side the bluffs are from one hundred to two hundred feet high, and Sleeping Bear Point, a promontory facing Lake Michigan west of Big Traverse Bay, is said to have an elevation of five hundred feet. Opposite this point, twelve miles out in the lake, the Manitou Islands rise abruptly to a height of two hundred feet above the water. South of the second correction-line the plateau rapidly declines toward Saginaw Bay. Between the north and south parts of the peninsula a depressed strip of land extends from Saginaw Bay to the mouth of the Grand River on Lake Michigan, having rarely more than one hundred feet elevation.

An astonishing number of smaller and larger inland lakes are found in every part of the peninsula; all have crystal-clear water, and the principal supply of the head branches of our rivers comes from them. The more important rivers collecting the waters of the western slope of the peninsula are the St. Joseph's, Kalamazoo, Grand, Muskegon, and Manistee. The three first named have their sources in close proximity to the elevated lands of Hillsdale and Jackson Counties.

From the same swell of land the River Raisin emanates, flowing outward into Lake Erie. The Raisin River enters the lake near Monroe; it drains the southern part of Washtenaw County, and draws its branches from a number of small lakes in the southeast corner of Jackson County through its main north branch. The south branches have the drainage of Lenawee County.

The St. Joseph's, Kalamazoo, and Grand Rivers almost touch each other within the small area of a few square miles in the County of Hillsdale. The St. Joseph's River originates in a number of small lakes and marshes in Hillsdale County, and enters Lake Michigan at the village of St. Joseph.

The streams which form the head-waters of the Kalamazoo River rise in Hillsdale County. The river runs north, west, and northwest, and falls into Lake Michigan near Saugatuck.

Grand River springs from a few lakes in Jackson County; it runs north and opens into Lake Michigan near Grand Haven.

Huron River collects its waters from innumerable lakes and marshes in Livingston and Oakland Counties, flows southwest, and at Dexter turns southeast and retains this direction until it enters the Detroit River in the northeastern corner of Monroe County.

Clinton River drains the eastern part of Oakland County and all of Macomb County, entering Lake St. Clair near Mount Clemens.

Black River is remarkable for its southern course for nearly fifty miles parallel with Lake Huron, at a distance of only five or six miles from it. It begins in the northern part of Sanilac County, and enters St. Clair River near Port Huron.

Saginaw River is the receptacle of a whole system of rivers. By the Tittibawassee River the waters of the north and west are led into it. The Shiawassee collects from the south, the Flint River from the south and southeast, and finally the Cass River brings its waters from the northeast and east.

The river system of the northern part of the peninsula consists of the following rivers: Commencing at the south-

east side, we first find the Rifle and Aux Grès Rivers, which drain the southeastern shore-belt surrounding the before-mentioned high plateau. Au Sable River is the next largest river north of them. It draws its branches right from the high plateau, and drains Otsego in the north end of it.

Thunder Bay River, opening into Thunder Bay, spreads its arms north, west, and south, reaching the foot of the high plateau. The Cheboygan River on the north of the peninsula forms the outlet of three large lakes—Black, Mullet, and Burt. These lakes are fed by rivers of good size. On the west side of the peninsula two large rivers deserve to be mentioned.

Manistee River originates very near the head-waters of the Au Sable River on the east side. Its mouth is at Manistee.

Muskegon River is larger than Manistee; its branches extend to the top of the central high plateau, and are fed by Higgins and Houghton Lakes. Of all the rivers mentioned, none are navigable. The water-power afforded by these rivers is ample, and those the branches of which flow through timbered lands are of vital importance to the lumber business as mediums for the transportation of felled timber from otherwise almost inaccessible parts of the interior to ports or railroad stations.

Relief Features in the Lower Peninsula.

SOUTHERN LOBE.

Northwestern slope.	Livingston Summit	350 feet.
	Ingham Summit	391 "
	Grand Ledge Summit	250 "
	Barry Summit	250 "
	Kent Summit	213 "
	Cass Summit. Oshtemo culmination	349 "
	Cass Summit. Cassopolis culmination	384 "

Southeastern water-shed.	Oakland Summit		539 feet.
	Washtenaw Summit		394 "
	Francis County Summit		411 "
	Hillsdale Summit.	Somerset culmination	600 "
		Cambria culmination	613 "
		California culmination	546 "

NORTHERN LOBE.

Roscommon Summit	820 feet.
Clare Summit (central water-shed)	750 "
Ogemaw Summit	850 "

Southern Division.

Crawford Summit	700 "
Wexford Summit	700 "
Osceola Summit	700 "

Northern Division.

Oscoda Summit	800 "
Otsego Summit	1,200 "

The rivers have all eroded their valleys into the loose drift masses which almost universally cover the surface of the peninsula in great thickness. Only in rare instances have they been deep enough to touch the solid rock ledges below the drift, or, if such deep cuts did exist, they have filled them up with *débris*, and the beds of the present streams lie high above those of former times. The peninsula was, in its original condition, heavily timbered, with the exception of a few marshy flats. Climate and quality of the soil determine the character of the vegetation. In the southern part of the peninsula deciduous trees, particularly hard-wood timber, prevail. Pine is only sporadically intermingled. The mildness of the climate favors the growth of the oak, hickory, walnut, poplar, etc., which abound here, but become rarer farther north, where beech, maple, and birch take their place. The sandy soil of the central high plateau is most congenial for the growth of pine forests, which have taken possession of nearly the en-

tire district. The marshy condition of some other places adapts them for the tamarack, elm, asp, and willow trees, or for the growth of the cedar, while a few parts of the high plateau, proving too sterile even for the pine, afford sustenance to nothing more than a stunted scrubby growth of *Pinus banksiana*, and a few creeping herbs which attempt to hide the barrenness of the scene. Such barrenness has, in some instances, been caused by fires which annihilated forests of large area, totally denuding the surface, and leaving it exposed to the burning rays of the sun and to the exsiccating winds, and unable for a long time, if not for ever, to recover its former well-timbered condition.

"The entire surface of the peninsula is covered by heavy drift deposits, with the exception of a few limited localities in which the drift, subsequent to its deposit, has been washed off by the floods, or by rivers curving their course deep enough to touch the rock-beds of older formation. These drift masses are almost the same as those of the upper peninsula. The material has been changed somewhat, by the admixture of rock-*débris*, from the formations encountered by the moving glaciers in their southern course. The glacier-drift spreads itself in a compact body over the entire surface of the lower peninsula, in evidence of which fact the rock-beds, wherever they are found denuded and the nature of the rock has been capable of preserving the marks, bear the traces of its motion on their scratched surface. Not all the drift material found on the lower peninsula has been transported there by glaciers; a large portion of it must have been carried southward by water, partly in suspension—as mud and sand—partly frozen with floating ice—as the coarser material, the gravel and the bowlder.

"The glaciers deposited moraines—heaps of rubbish composed of all kinds of rock-*débris* in every degree of com-

minution, from the large bowlder down to the impalpably fine clay.

"Much of the drift is not found in this orderless form of moraines, but is disposed in well-stratified layers, assorted, according to the weight of its particles, by water-currents."

A long time of submergence of the land must have followed the glaciers. The surface of the highest points of the peninsula, 1,100 feet above the level of the lakes, is formed by stratified drift-sand, mixed with pebbles.

"The older glacier-drift and the later deposit of floods and icebergs are materially of the same composition; both are made up of clay, sand, gravel, and bowlders of detritus from crystalline and metamorphic rocks, mixed with *débris* of younger sedimentary strata."

The coarse bowlder-drift all through the southern part of the peninsula appears not to occupy the lowest position, in which most frequently a hard, dark blue, sandy clay, with pebbles and some bowlders intermingled, is found in layers of considerable thickness. It is known among laborers by the popular name of hard-pan.

"Bog-iron occurs very frequently in small patches of marsh lands in all parts of the State."

"As another surface deposit, peat has been mentioned. Innumerable larger and smaller patches cover the swampy surface depressions throughout the whole State."

The soil of the lower peninsula, being a drift-soil, is generally very deep, and contains all the chemical constituents of a good soil.

The assortment of the drift-soil into clay, sand, and gravel determines its character as the layers happen to occupy the surface positions, while by intermixture a great variety of intermediate shadings in the quality of the soils is locally produced under atmospheric influences. The distribution of soils over the State is sometimes very unequal

and changeable, so that within limited areas, and often within single farms, a number of variations in the character of the soil are represented. But with the differences seen in the surface configuration of certain districts is also usually found a corresponding contrast in the quality of their soil. The high plateau in the northern part of the peninsula has its peculiar soil, a thick, uniform mass of fine sand, containing few pebbles and a small proportion of argillaceous constituents. In accordance with it is its vegetation; the pine-tree finds a congenial home in these sandy hill-lands, and their surface is overgrown with splendid forests of this tree, to the exclusion of almost every other kind.

"Other districts—represented by lowlands adjoining the lakes, and, to all appearances, within comparatively recent times parts of the lakes' bottoms—are covered by a stiff clay soil overgrown with elm, ash, and kindred trees, as, for instance, the lower part of Saginaw Valley and a strip of land bordering Detroit River, from Monroe up to Lake St. Clair.

"The climate of the peninsula, which is the other principal factor in its productiveness, is over the whole extent temperate, extremes of heat or cold being prevented by the surrounding lakes. From the northern to the southern end all the cereals can be planted with little risk of failure. The northern part is somewhat cold, its vegetation coming out two weeks later than in the south, and the winter setting in that much earlier, which affects somewhat the raising of the more tender fruit crops, as grapes, peaches, etc.

"The grape and the peach do well in the southern part of the State, and particularly near the shores of the great lakes, where the foggy, humid air prevents late frosts, the greatest enemy of these fruits. The west shore up as far as Muskegon has become famous for its peaches and other small fruits."

"Beneath the drift the peninsula is underlaid by regularly stratified rock-beds, in undisturbed horizontal position, which represent the upper part of the palæozoic strata."

DEATHS BY PHTHISIS PULMONALIS IN THE STATE OF MICHIGAN.

Record by Counties.

COUNTY.	Population in 1870 and 1880.	No. of deaths from phthisis from 1869 to 1882.	No. originating in county.	Primary	Secondary.
Alcona	766 & 3,107	155	11	2	
Allegan	32,093 " 37,815	506	5	3	2, '83–'84
Alpena	2,756 " 8,780	58			
Antrim	1,985 " 5,237	37			
Baraga	1,804	17			
Barry	22,204 & 25,317	332			
Bay	15,820 " 38,081	415			
Benzie	2,148 " 3,433	45	4	..	'81–'84
Berrien	35,119 " 36,785	602	4	3	1, 82'–'84
Branch	26,229 " 27,941	467	15	13	2, '80–'84
Calhoun	36,571 " 38,452	653	23	12	4, '80–'85
Cass	21,097 " 22,009	308	9	..	'78–'84
Charlevoix	1,724 " 5,115	63	3	2	'82–'84
Cheboygan	2,197 " 6,524	30			
Chippewa	1,690 " 5,248	63			
Clare	266 " 4,187	22	3	1	'82–'84
Clinton	22,852 " 28,100	348			
Crawford	1,159	2			
Delta	2,441 & 6,812	43	6	6	'60–'70
Eaton	25,164 " 31,225	450	29	18	5, '70–'85
Emmet	1,211 " 6,639	84			
Genesee	33,965 " 39,222	515	32	2	'81–'84
Gladwin	1,127	3			
Grand Traverse	4,443 & 8,422	65	3		'80–'84
Gratiot	11,809 " 21,936	180	13	63	'70–'84
Hillsdale	31,691 " 32,723	577	19	10	9, '79–'85
Huron	9,049 " 20,489	135			
Ingham	25,270 " 33,6 6	424	2	1	'82–'84
Ionia	27,676 " 33,872	469	100	16	1, '57–'84
Iosco	3,175 " 6,873	56	5	2	3, '75–'84
Isabella	4,113 " 12,159	172			
Isle Royal	55				
Jackson	36,042 & 42,031	550			
Kalamazoo	32,063 " 34,342	618	15	12	3, '70–'84
Kalkaska	424 " 2,937	12			
Kent	50,410 " 73,253	1,114	28	16	2, '69–'84

DEATHS BY PHTHISIS PULMONALIS IN MICHIGAN.—(*Continued.*)

COUNTY.	Population in 1870 and 1880.	No. of deaths from phthisis from 1869 to 1882.	No. originating in county.	Primary	Secondary.
Keweenaw.....	4,209 " 4,270	27			
Lake.....	548 " 3,232	22			
Lapeer.....	21,345 " 30,138	314			
Leelenau.....	4,577 " 6,253	81			
Livingston.....	19,417 " 22,251	324	98	68	15,'56–'84
Lenawee.....	45,503 " 48,343	693	35	9	17,'70–'85
Michilimackinac.	1,716 " 2,992	44			
Macomb.....	28,050 " 31,627	544	8	4	3, '68–'85
Manistee.....	6,074 " 12,532	109	30	13	17,'72–'84
Manitou.....	891 " 1,334	11			
Marquette.....	15,077 " 25,394	258	10	10	'81–'85
Mason.....	3,266 " 10,065	87			
Mecosta.....	5,645 " 13,973	122	21	9	5, '82–'84
Menominee.....	1,894 " 11,987	25	1	1	'80–'84
Midland.....	3,383 " 6,893	80	13	4	1, '80–'84
Missaukee.....	1,553	5	4	2	'64–'80
Monroe.....	27,534 & 33,624	470	30	19	11,'82–'84
Montcalm.....	13,642 " 33,148	295	36	14	20,'71–'84
Montmorency...	....				
Muskegon.....	14,895 " 26,586	251	49	39	10,'74–'84
Newago.....	7,292 " 14,688	107	10	4	6, '80–'84
Oakland.....	40,906 " 41,537	618	65	35	13,'74–'84
Oceana.....	7,222 " 11,699	160	5	2	3, '80–'84
Ogemaw.....	1,914	6			
Ontonagon.....	2,846 & 2,565	34	2	..	2, '77–'84
Osceola.....	2,104 " 10,777	62	15	14	1, '72–'84
Oscoda.....	467	1			
Otsego.....	1,974	2			
Ottawa.....	26,665 & 33,126	455	6	..	2, '83–'84
Presque Isle....	3,113	14			
Roscommon....	355 & 1,459				
Saginaw.....	39,078 " 59,095	915	62	25	30,'78–'84
Sanilac.....	14,565 " 26,341	250	14	9	2, '72–'84
Schoolcraft.....	1,575	9			
Shiawassee.....	20,864 & 27,159	307	15	5	10,'81–'84
St. Clair.....	36,687 " 46,197	572	29	18	11,'66–'84
St. Joseph.....	26,274 " 26,626	430			
Tuscola.....	13,721 " 25,738	247			
Van Buren.....	28,735 " 30,807	478	9	6	3, '79–'84
Washtenaw....	41,442 " 41,848	683	13	7	6, '78–'84
Wayne.....	119,054 " 166,444	4,237	396	237	85,'75–'84
Wexford.....	650 " 6,815	45			

In the foregoing report it will be seen that under the heading of County is given the name of each county; under the heading of Population is given the population by counties in 1870 and 1880, and under the heading of Number of Deaths by Phthisis is given the total number of deaths from phthisis from 1869 to 1882, inclusive. The column marked Number of Cases originating in County gives the cases reported to me from various physicians as having originated in their county, with the year of their appearance. Of these, the remaining columns, marked Primary and Secondary, will show the number of cases as far as known which were primary, and those which arose secondarily to some other malady.

It will be seen by these tables that the whole number of deaths from phthisis pulmonalis, as reported to the State Board of Health, from 1869 to 1882 (thirteen years) is 22,103, or an average of 1,700 a year. Of these, 1,241 were reported in 1869 and 1,979 in 1882.

During 1882 rain fell 179 out of the 365 days, with a total fall of 30·31 inches, which was about the average fall for the preceding ten years. The mean temperature for 1882 was 51·2, which was slightly higher than the average for the preceding ten years.

The whole number of cases reported to me as having originated in the State between the years 857 and 1885 is 1,370, and of these, 673, or nearly one half, were reported as primary, while 205 were reported as having been secondary to some other disease.

Of the total number of original cases (1,370) from 1857 to 1885, 602, or a little less than one half, occurred between the years 1879 and 1885, or during a period of six years.

The total population of the State, according to the census, in 1870 was 1,184,059, and in 1880 was 1,856,100, showing an increase of 672,041; so that proximately, so far

as learned, the percentage of deaths from original cases to population would be about $\frac{7}{100}$ per cent., which no doubt is somewhat below the truth; but, as before remarked, these statistics are necessarily inaccurate (as are all United States vital statistics). However, if enough has been elicited to awaken an interest in the further investigation in this line, the work may not prove entirely valueless.

NOTE.—A very full and able account of the climate and topography of Michigan, illustrated by numerous maps, by Dr. H. F. Lyster, of Detroit, may be found in the "Report of the Michigan State Board of Health," for 1878.

The New York Medical Journal,

A WEEKLY REVIEW OF MEDICINE.

PUBLISHED BY
D. Appleton & Co.

EDITED BY
Frank P. Foster,
M. D.

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